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Knowledge and Teaching Skills of Mathematics Teachers in FVR National High School of Norzagaray, Bulacan: Basis for an Enhancement Program

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KNOWLEDGE AND TEACHING SKILLS OF MATHEMATICS TEACHERS
IN FVR NATIONAL HIGH SCHOOL OF NORZAGARAY, BULACAN:
BASIS FOR AN ENHANCEMENT PROGRAM

A Special Project

Presented to the

Faculty of the Graduate Teacher Education

College of Graduate Studies and Teacher Education Research

Philippine Normal University

In Partial Fulfillment

of the Requirements for the Degree of

Master of Education in Educational Management

By

Ann Christine P. Lualhati

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Adviser

April 2017

ABSTRACT

Name	:	Ann Christine P. Lualhati
Title	:	Knowledge and Teaching Skills of Mathematics Teachers in FVR National High School of Norzagaray, Bulacan: Basis for an Enhancement Program
Key Concepts	:	Mathematic teaching, level of knowledge, teaching skills
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The pressure for improving the teaching of mathematics overlooks key factors: the teacher's knowledge and teaching skills. This descriptive study aimed to know the level of knowledge and teaching skills of mathematics teachers in FVR National High School to be used as basis in recommending appropriate enhancement programs.

The assessment of the mathematics teachers themselves revealed that they were high in terms of teacher's knowledge and teaching skills. This means that mathematics teachers in FVR National High School have mastery of the subject matter; have broad knowledge of the pedagogical content; and they are well prepared for teaching instruction. Furthermore, this means that mathematics teachers were effective in their classroom management. They use appropriate instructional materials in teaching of mathematics. Also, they used suitable teaching strategies.

The result of this study showed a satisfying outcome as far as the perceptions of teachers and students are concerned. However, not all aforementioned areas have been reached to the maximum level especially on the part of the students' assessment which simply implies that there is still room for improvement. Hence, this study recommends the development and implementation of the suggested enhancement programs on the level of knowledge and teaching skills of mathematics teachers.

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Chapter I

THE PROBLEM AND ITS BACKGROUND

Introduction

The science of Mathematics is a broad and practical field. It is characterized by constantly changing requirements of the other sciences. It has made possible the development of all fast moving and complicated machines and is attributed much to society's development and progress. The knowledge of Mathematics far extends its application in everyday living. Its mark can be seen not only in the simple task of man but more in complex businesses and inventions. Mathematics contributes directly or indirectly to most phases of modern civilization because it is necessary for the development and use of other sciences and arts.

With many great breakthroughs in the technology, the role of Mathematics has become more pressing. It is from this premise of importance that the need to be concerned with the problem besetting the study of mathematics arises. Such concern stems from the fact that the students' earliest exposure to the fundamentals of mathematics will inevitably affect man's advancement in science and technology. This situation necessitates the reprogramming of teacher education and retooling of teachers in mathematics.

The economic growth of a nation today is no longer driven by the wealth of material resources alone, but by the new engines that run on knowledge, skills, and attitudes. Teachers of mathematics must wear multiple hats and become researchers, facilitators and community leaders if they are to contribute meaningfully to national

development (Lagunzad 2006). One needs to understand what he or she has to teach. This direct correlation has been established. Teaching effectiveness is hinged on teacher's knowledge and familiarity of the subject matter being taught. (Alijade 2004).

Apart from a teacher's capacity to understand what he or she needs to teach, it also has to make sense when he or she teaches it to his or her students. The quality of explanation is a facet of teaching effectiveness to gives ease to the comprehension of students. (Fazio and Roskes 2005). The teacher's actual teaching skills given the learning circumstances of the students also play a pivotal role to promote order and genuine classroom learning. (Glover 2005)

In the field of instruction, teachers are the transmitters of learning in the society. To function effectively, mathematics teachers need to equip him with knowledge and skills. Quality instruction and continuing professional education are requisites to the development of competent mathematics teachers who can be counted upon to meet the new challenges of the century. If one thinks of the Philippine educational system as being similar to a sick individual, one of the most alarming symptoms of this patient has to be the poor achievement of the Filipino students in the area of mathematics. Different observers and stakeholders of the Philippine educational system have proposed a variety of diagnosis and cure to this ills of mathematics education. But amidst the various proposals, there seem to be a consensus that one of the major causes of the problem is teacher factor (Bernardo 2004).

A recent study done by the Department of Science-Science Education Institute (DOST-SEI) on mathematics faculty qualifications among sixteen (16) selected Teacher

Education Institutions (TEIs)-- mostly Center of Excellence (COEs with 6 in Luzon, 4 from Visayas & 6 from Mindanao)—produced preliminary faculty profiles that remain useful today since 2006. During the survey period of this study in 2004 and 2005, tremendous losses were suffered in the ranks of faculty members with doctorates mathematics because of vicissitudes of foreign employment and retirement. Apart from the teacher factor issues previously mentioned, the training of future faculty members were severely compromised by this massive loss to retirement and foreign opportunities. (Ogena 2006).

Truly, Filipino teachers are overworked, underpaid and unrecognized. Teachers felt so undervalued and frustrated but in spite of all the hardships from poor pay and deplorable working conditions, they are still there. A significant fraction of the country's most competent teachers have gone abroad to seek greener pastures for themselves and their families (Abad, 2004).

According to Ibe and Ogena as cited by Morilla (2012), the situation in mathematics teaching is critical because of the inadequate supply of qualified teachers to mathematics. Given this situation, there is a need to provide in-service training to empower most mathematics teachers with the healthy combination of content knowledge and teaching skills for this subject. Gullas (2006) stressed that the problem was being aggravated by the lack of properly trained instructors.

Competency in mathematics precedes individual and societal economic success in the future. The combined exigencies of democracy, global market movements, and technological advancements all require a high level of mathematical literacy not demanded in past circumstances. Contrary to popular belief, success in mathematic foundations is not

just something that is taken from computational efficiency. The more important application involves being able to solve real world problems, glean various sources of information, and use quantitative data to decide with mathematical soundness in real life. (National Council of Teachers of Mathematics (2010).

Students' proficiency and capacity to learn is influenced heavily by teachers as numerous studies suggest. Specific studies of elementary schools with value-added modeling indicate the tremendous impact of teachers to their students (Rowan,et.al. 2012). The quality of education is anchored heavily on a teacher's ability to fulfill his or her duties to his or her students. As such, academic performance became a barometer for teaching success and a gauge of the effectivity of the teaching process. (Ajao 2008).

Teachers provide the insights from actual practice of theories during interaction with their students that make them instrumental to the students' academic achievements (Afe 2001). Both teaching and learning are anchored on the teachers; through their performance of their duties, they produce the necessary results for their students. (Uchefuna, 2009).

It is in this context, therefore, that the researcher has developed the desire to undertake this in-depth study to determine the knowledge and teaching skills of mathematics teachers in FVR National High School.

Theoretical Framework of the Study

Constructs of the study were drawn from the concepts of knowledge and skills of mathematics teachers.

Rudolf Dreikurs as cited by Bucher (2003) believed that a collaborative and vibrant learning community can be formed between teachers and students when teachers are empowered to act in a democratic environment. Dreikurs based his theory of democratic teaching and management on the beliefs first proposed by Alfred Adler (1927, 1930). Adler relies on the main assumption that individuals are inherently motivated to interact with others and pursue their interests. He believes that this inherent quality needs nurturing during childhood years to take effect during adulthood or maturity.

The proponent of the said theory maintained that “in order to be effective, the teacher has to know more than the subject matter”. This advocates the promotion of a thriving and democratic classroom in accordance with the concepts in Dreikur’s theories. A democratic classroom owns up to several beliefs, including but are not limited to the following: dignity, equality, freedom of expression, and a fundamental trust in each individual’s ability to make wise decisions.

However, Gardner’s Multiple Theory of Intelligence reminds everybody that students have multiple aptitudes. In addition to having linguistic or language ability and logical-mathematical ability, they also possess abilities in spatial matters, body kinesthetic, music, interpersonal relations, self-understanding, and pattern recognition. Thus, Gardner and the others want to recognize and nurture the diversity of abilities different students have (Cruickshank and Jenkins 2006).

In addition, Gardner’s multiple intelligence theory, according to Moore (2001) as cited by Arceno (2008) provides the classroom teacher with two valuable tools that highlights individual learning abilities of students. First, it involves assessing the individual

student's strengths or abilities. The second tool involves the recommendation for teachers to create a well-rounded and diverse set of classroom activities that taps different areas of intelligence.

Furthermore, the theory on human cognitive development presented by Jean Piaget, a Swiss psychologist, and his collaborators is probably the most widely influential among all of the modern theories of cognitive development. To determine the readiness of a child to learn a particular concept of what is to be taught, a teacher should correlate it with what is known about the cognitive structure of the child at that age. His theory assumes that all young people pass through the same four stages in their cognitive development and they pass through the same stages in exactly the same order. Piaget's ideas have a number of important educational implications about what to teach students and when to teach it (Religioso 2004).

The discovery method sprang from the cognitive theory of learning. The cognitive theory is one of the two major positions on learning, the other being the stimulus – response theory. According to J. Bruner, learning is an “active process of discovery influenced by the prior knowledge and ability of the learner.” The application of his idea to classroom teaching is on discovery learning. Using the discovery method, students learn how to learn. They acquire new knowledge by discovering for themselves. (Bruner 2005)

Guskey (2000) as cited by Arceno (2008) discovered in his theory that positive effects were obtained in greater degrees when teachers were engaged with imparting knowledge which is directly relevant to what the students need. These students learn the

lessons well and fast if they feel that these are directly involving them in different activities which transpired during the teaching – learning processes.

The Theory of Cordier (2003) as mentioned by Arceno (2008) stated the fundamental assumption of constructivism: that people harness knowledge based on the new idea's interaction with existing belief systems. Exploration and active learning are more effective in constructing knowledge, making them active doers instead of passive recipients.

According to Allport (2000) as cited by Arceno (2008), skills must be applied rather than practiced in isolation, and it is important for students to receive instruction when and how to apply skills. Allport theorized that students attempt to reflect on their knowledge and skills with the main objective of applying in real life what has been learned inside the classroom.

Callahan and Kellough (2002) as mentioned by Arceno(2008) were of the opinion that effective teachers possess a unique combination of professional skills. These skills foster and inspire students to learn more and can be continuously improved over time. Four aspects govern these professional skills: tapping students' inherent attention span, fostering meaningful interaction between student and teacher, optimizing classroom time, and providing adequate feedback that encourages sustained reinforcement of concepts learned.

In this particular study, the researcher takes into consideration two areas, namely: knowledge and skills. Cordier (2003) as mentioned by Arceno (2008) states that in the use of the various teaching practices, especially in the implementation of various instructional

strategies or methods, the teacher needs to be well-prepared to put these into proper practice and application.

On the basis of these areas of the level of knowledge and skills, the teacher's level of effectiveness were determined and they were categorized as follows: "very high", "high", "moderate", "low", or "very low". Figure 1 below shows the schematic diagram illustrating the hypothesized relationship of the variables included in this study.

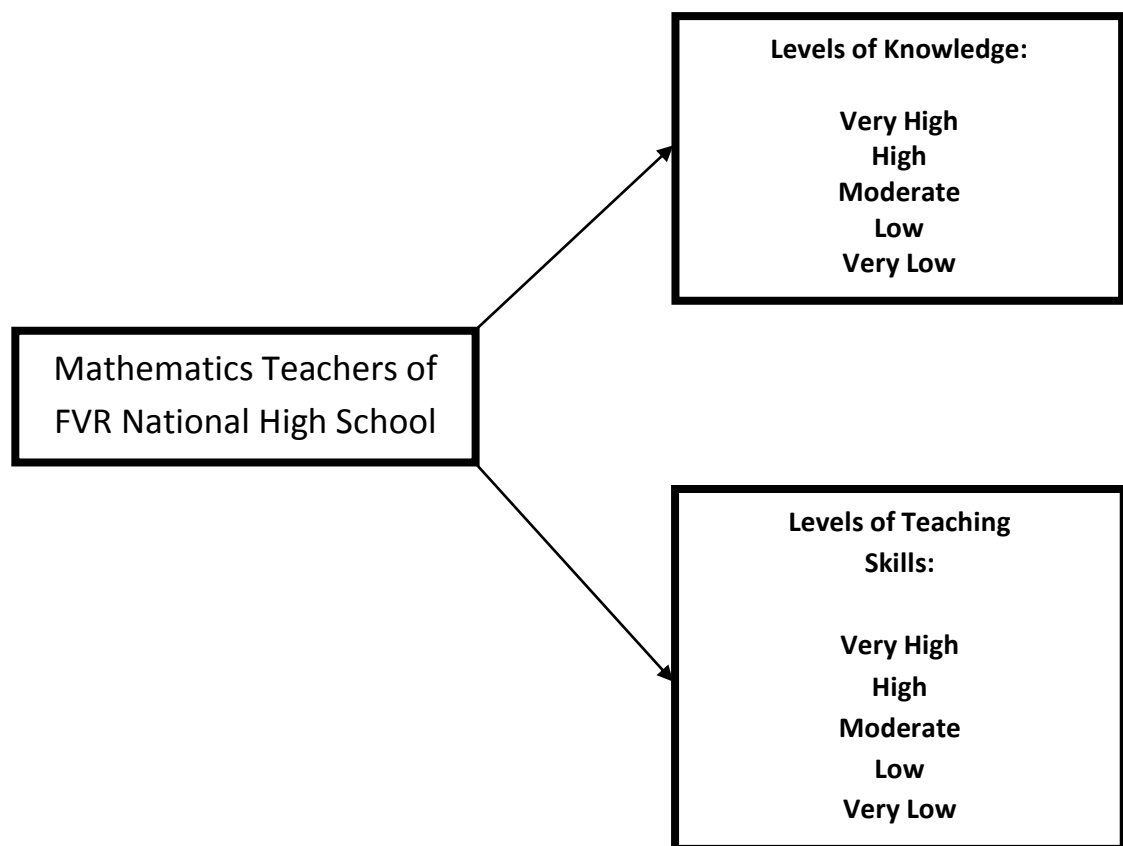


Figure 1

A Schematic Diagram Illustrating the Hypothesized Relationships Among Study Variables

Statement of the Purpose

This study sought the levels of knowledge and teaching skills of mathematics teachers in FVR National High School of Norzagaray, Bulacan during the school year 2016-2017, the result of which can be used as basis for an enhancement program in teaching mathematics.

Specifically, this study answered the following questions:

1. What is the level of knowledge of the mathematics teacher in FVR National High School as assessed by the two sets of respondents (teachers and students) in the following aspects:

- a. mastery of the subject matter,
- b. pedagogical content, and
- c. teaching preparation?

2. What is the level of teaching skills of mathematics teachers in FVR National High School in consideration of these areas:

- a. classroom management,
- b. appropriate use of instructional materials, and
- c. teaching strategies?

3. Are there significant differences between the assessments by the teacher and by the students towards teaching skills of mathematics teachers in FVR National High School?

4. Based on the outcomes of the survey, what enhancement program can be developed as a basis to improve the mathematics teachers' knowledge and teaching skills in FVR National High School?

Hypothesis

Based on the objectives of the study, this hypothesis was developed:

There are no significant differences between the assessments of mathematics teachers and their students regarding the levels of knowledge and teaching skills of Mathematics teachers in FVR National High School towards mathematics.

Scope and Delimitation of the Study

This study was conducted to determine the level of knowledge and teaching skills of mathematics teachers in FVR National High School during the school year 2016-2017. The respondents of the study who served as assessors were composed of the two sets namely, the Mathematics teachers of FVR National High School in Norzagaray, Bulacan and their students. They were the main sources of the data needed for the study.

In view of financial and time constraints on the part of the researcher, FVR National High School in Norzagaray, Bulacan was purposefully chosen for these reasons: a) the researcher is a present permanent teacher in public school and b) the researcher is currently handling Mathematics as her teaching subject.

Owing to the aforementioned constraints, generalizations were applied only to the cases being studied. Findings and conclusions that were made in this study was based solely on the data gathered through questionnaires developed for the identified two sets of respondents. Data analysis and interpretation was limited to the study objectives and statistical techniques employed.

Significance of the Study

This study on the levels of knowledge and teaching skills of mathematics teachers towards mathematics curriculum contributes to the realization of one of the objectives of Philippine education. The results of this study may be of great importance and help to the following:

Educational Planners. The findings of this study will be valuable inputs for training, retraining, and sourcing of the educational needs of all the mathematics teachers in present service.

Department Heads. The findings of this investigation will provide the department heads with useful inputs for enhancing students' achievements through the design of a training program for the teachers to develop and enhance their teaching performance. Results of the study will serve as a basis for providing teachers with more training, seminars, and workshops and the like especially on the two aspects that need to be given priority.

Mathematics Teachers. This study will give information to mathematics teachers so that they can update their teaching styles and methodologies and to have better performance and efficacy. This study may motivate them to perform better and pave the way for a self-evaluation of their own performance and improve commitment and dedication towards their profession.

The Agencies and other Concerned Linkages. A workable collaboration will make strategies, innovations, and other related outputs produce the utmost in development and student welfare.

Graduate School Students. The results and findings of this study will direct graduate school students in the conduct of an inquiry or further studies relevant to their work. This will make them more aware about the emerging role of mathematics teachers in the learning process.

Mathematics Students. This study will benefit and guide advanced mathematics students in the formulation of latest mathematics concepts and will gain improvement especially about mathematics advancement.

Community. Findings of this investigation will generally benefit the community as mathematics teachers are bound to perform efficiently and effectively at work and will consequently improve to develop productive citizens whose lives they will touch and influence.

Other Researchers. This research work will serve as baseline data or literature to conduct similar future investigations using other variables not found in this study.

Definition of Terms

For a more thorough understanding of this study, the following terms are defined conceptually and operationally.

Knowledge. Conceptually, the term refers to acquaintance with theoretical or practical understanding of one branch of science or other areas involving study, practice and acquisition of skills. Operationally, it refers to the teachers' mastery of the subject matter.

Skills. The term refers to the ability to use one's knowledge effectively and reality in execution of performance. As used in this study, the term refers to the ability of teachers to use different techniques and approaches in teaching Mathematics.

Mathematics Teacher. The term refers to someone who teaches mathematics. Operationally, the term is used to refer to the public high school teachers of FVR National High School who handle Mathematics subject and were used as subject-respondents of the study.

Mathematics. Conceptually, the term refers to a “systematic treatment of magnitude, relationships between figures and forms, and relations between quantities expressed symbolically.” Operationally, the term pertains to the subjects specifically Numbers and Number Sense, Patterns and Algebra, Advanced Algebra, Measurement, Geometry, and Statistics taught by the Mathematics teachers.

Enhancement Program. Conceptually, the term refers to a program with scope that goes beyond the normal education content of a course of study and that is fuller and broader for students of high academic ability. Operationally, it refers to the activities that will improve the knowledge and skills of Mathematics teachers.

Chapter II

REVIEW OF RELATED LITERATURE

This chapter presents the various studies and concepts which primarily deal with the level of knowledge and teaching skills of mathematics teachers toward mathematics. There is a significant amount of materials that address these issues and common themes are noticeable which served as a benchmark in outlining the methods of the researcher in this study.

Related Literature

The researcher reviewed literature regarding the level of knowledge and teaching skills of mathematics teachers toward mathematics which bore some relevance to the present investigation. The body of knowledge the researcher gained from the review of local and foreign materials provided her with the essential frame of reference which guided her in formulating study objectives and hypotheses as well as in deciding the appropriate methodology.

Level of Knowledge

At present, there is an existing skills gap for a higher level of thinking skills required by technological advancements. People are now accessing information and employing critical thinking skills in a different way. There is now a new definition of the phrase “intellectually competent.” Skills in critical thinking, problem solving, and communication are lacking in most younger generations of employees (Harris, 2015).

Educational strategies are fortunately being adapted to address this skills gap and it's the best starting point to deal with the problem at hand brought by modernization.

Urbano (2008) commented that the state provides specific requirements for middle school teachers practicing in their area. At a minimum, a bachelor's degree and accompanying training from a teacher training curriculum is sought after as a primary requirement. In addition, some states even require a master's degree to be able to practice. Comparing the elementary teachers with the middle school teachers, the latter usually specialize in a specific subject such as Mathematics, English or Physics. The common route is to get a Bachelor's degree majoring in their subject of interest before proceeding to get education units and a Master's degree.

Rimando (2006) added that the Department of Education (DepEd) stressed that the teaching of mathematics and science by teachers who are not majors of the said subjects serve as the main cause of poor performance of many high school students in the Cordillera Administrative Region (CAR). However, this problem could be remedied at once according to the CAR DepEd regional office due to the implementation of "Capability Building Program" that will help enhance the instructional competencies of the non-specialist mentors in Mathematics and science (physical and chemistry, physics and Mathematics) through: 1.) enriching non-specialist teachers' knowledge on contents and teaching strategies in chemistry, physics and Mathematics; 2.) strengthening the ability of the mentors in the assessment of performance of students in three subjects mentioned; and 3.) providing the needed skills of different science laboratory equipment and other instructional devices.

Another key issue is the role of experience in evaluating or influencing a teacher's overall performance. Villamin (2011) discussed experience in relation to performance seen in students' test scores. Policy changes that remove the palpable role of experience in salary considerations are often a source of arguments from officials and administrators. The relationship between teacher's length of service and salary is context-dependent

Juacalla (2007) stated that experienced teachers may be considered to become "reflective practitioners who work collaboratively in learning communities and demonstrate that their teaching leads to increase in students' achievement."

More than education background, a huge percentage of employers prefer to check out critical thinking skills of their teaching applicants (ACCU, 2013). This has changed the landscape of modern hiring of teachers and put new things in the forefront. Companies now look for the 21st century skills that lead to better adaptation in existing teaching teams in terms of planning, decision making, and implementation.

Shah (2009) claimed that any system of higher education improves qualitatively with the level of continuing professional development of teachers. This professional development capitalizes on the knowledge and skill of the teachers at an individual level. Any teacher, with sincerity and ability to access opportunities from the learning institution, can improve. For example, access to books makes a tremendous difference where in an individual setting access to certain books for enrichment is not possible. Competent institutions maintain good libraries for this very reason and the institution undertakes the key responsibility of providing access to topnotch materials for its teachers. Apart from this, excellent institutions have a steady schedule of training programs to enhance teachers'

skills. These professional development activities are done for various reasons such as a) desire to improve quality, b) research initiatives of teachers, c) competitive improvements among institutions for innovation, and d) catering to a diverse student population that cannot thrive under extremely uniform teaching methods.

Teaching Skills

According to Weaver (2003) as cited by Arceno (2008), an impeccably skilled teacher is driven by the pursuit of disseminating knowledge in the best way possible. Over the years, a teacher needs to maintain the quality of transmitting information to students and building their skills through the adequate knowledge transfer. Aware of his influence on the learners, the teacher is always focused on the principles of learning.

According to Ornstein (2000) as cited by Arceno (2008), a teacher's behavior, teaching methods and skills consistently relate directly to student's achievement. It is in this aspect of teaching that the teacher, conscious of his role, must be made aware of his teaching performance.

All effective teachers share a good knowledge base of their subject matter expertise and good teaching skills. They possess both the savvy of teaching logistics such as "goal setting, instructional planning, and classroom management." In addition to this, they can relate warmly to a diverse set of students as reported by Arceno (2008).

Learning is a prerequisite to declare that teaching has successfully taken place in a classroom situation. The classroom activities become futile and are not considered as part of real teaching if a teacher's students have not learned anything. When students fail, the bigger failure rests on the shoulders of the teacher. Groosman (2006) suggests that the

teacher's scope of knowledge determines the scope or areas where he or she can provide good teaching coverage for students. A more knowledgeable teacher is also known for posing more challenging and interesting questions for his or her students because he or she is secure in the content of his teaching.

Aside from what was previously mentioned, an effective teacher must not just demonstrate a thorough understanding of the subject. He or she must also be flexible with the knowledge in his or her field of expertise, conceptual with his or her approach, and thoughtful in his or her attitude. Knowledge is not just limited to general concepts, terms, or facts. There must also be arguments, thoughts, change of patterns in the discipline, beliefs, and ability to transmit the ideas from his or her discipline to another. (NASSP, 2007)

Joyce and Weil (2000) cited by Arceno (2008) suggest there are many kinds of effective teachers. They further suggest that different teachers are effective under different circumstances. A teacher might be quite effective at the elementary level but quite ineffective at the secondary level, or vice versa. Since elementary teachers are required to teach all areas of the curriculum, whereas secondary teachers usually teach in only one or two curriculum areas, subject matter instruction will usually be much deeper at the secondary level. Thus, observing instruction at the elementary and secondary levels, one must take note which specific skills are necessary for effective teaching at each level.

According to Rice (2010), in education, teacher experience affects employee the most in the standpoint of educational policies. The adage "more is better" is given credence in more than 40 years of teacher related research. In reality, experience is a complex variable that is affected by multiple factors.

Mathematics Teaching

According to Pollard (2007), the benefits of investing in training are self-evident both to staff members and the organization or school itself. For the school or organization, benefits include the following: 1) enhancement of product offering to clients; 2) access to new knowledge in fields such as Teaching English as a Foreign Language (TEFL); 3) application of the learnings in the classroom; 4) motivation is sustained for topnotch teachers in the organization; 5) insurance against “routinization”; and 6) direct resolution of training deficiencies of poorly performing faculty members.

Training in service is not just lauded by a single body of research. According to Ycogo (2010) in-service training is “an integral part of the total school program that of providing the teachers every opportunity to observe progress in teaching.” In order to be more effective, there is a need to give follow-up activities for the training conducted in order to support and maintain the learned skills. In-service training includes conferences, seminars and workshops which can keep the faculty abreast of new developments in their profession.

The documentation of Van Dalen and Brittell as cited by Lasco and Baguinat (2009) highlighted the impact on teacher’s efficiency of maintenance and improvement. It is only through staying abreast of research developments, new philosophies, and cutting edge methods that a teacher can “hold the status of a competent professional practitioner.” Innovations are uncovered and the educational system maintains its quality through these in-service trainings that upgrade the skills of the institution’s teachers habitually.

Trainings and seminars are important tools for teachers to uplift themselves professionally and for them to cope with the innovations in the different fields of learning. It is for this reason that Aquino as cited by Del Castillo (2010) stated in his study that training is a never-ending task because of new technology. Training and development of personnel should be given special importance to increase organizational productivity and improve employees' morale.

Despite the benefits, not all teachers take advantage of in-service trainings. "Available evidence indicates that relatively few primary school teachers take up continuing professional development in Mathematics, and that take-up has decreased over the last ten years" (House of Commons Public Accounts Committee, 2009). Some possible reasons for this inability to harness the power of trainings in upgrading teacher skills include the lack of background in Mathematics for most primary school teachers. The focus is also more on general school improvements over specialized mathematical teaching improvements. Mathematics coordinators may take it upon themselves to train younger teachers to address the lack of specialized knowledge in Mathematics among primary school practitioners.

In terms of length of service, Daran (2010) stated that the length of service is a good gauge of one's efficiency and effectiveness. As the saying goes, "experience is the best teacher." The longer the experience of the individual, the better is his attitude towards his job and the greater the assurance of better performance. In light of this, Mryyan and Al-Faouri (2009) "proposed that the length of service increases the likelihood that

employees will receive more challenging job assignments, greater autonomy and discretion at work, and receive higher levels of extrinsic rewards.”

Ampo, (2007) added that the length of service is assumed to influence one’s performance in his work. There are cases where the longer the individual stays in the service, the more he becomes motivated to work; however, some workers feel the opposite.

Aranilo (2010) commented that the aim of in-service training among faculty members is to bring them up to “standard.” This involves addressing the inadequacies presented by pre-service education to some teachers. All teachers ought to have progress in their teaching practice as an integral part of the school’s overall program. New developments in their profession are found in in-service training modes such as workshops, seminars, and conferences.

Agapay, (2011) commented that changes in teachers’ beliefs, behavior and knowledge can occur with the right exposure to effective training methods.

Jocson (2007) cited that trainings keep employees abreast with new ideas and make them more effective in their present job or become better qualified for another job. Training, therefore, helps enhance the ability of human resources and make them productive. Subsequent training is needed by all employees on a systematic basis not only in terms of improving their work but also in taking advantage of opportunities for promotion.

Universities offering teacher education programs must have a continuing professional education and development plan (CPE) to raise the initial qualification of its teaching and non-teaching staff, thereby attain a high standard of teaching performance and

values inculcation (Salandanan, 2007). Modes of continuing professional education may be done by having an update model wherein professionals are provided with levels of knowledge and skills comparable to those graduating at the time; a competence model wherein the required competency is provided to continue practice and is measured by the capacity to perform and performance itself; and performance model which focuses on all variable which have demonstrated to have a strong influence on professional's performance and based on the act of performing a job efficiently, skillfully and completely.

On educational attainment, Ycogo (2010) stressed that "teachers must have a thorough grounding in the subjects they teach so they can guide their students effectively through the materials and respond knowledgeably to questions and comments." Their degree and certifications serve to indicate prior education as the source of their knowledge.

On the aspect of specialization, Gao-ay (2008) said the there are three (3) main causes of the failure of the students. These are as follows: teachers or academic causal factors, parents or family causal factors, and students or personal causal factors. Among the three factors, it is commonly observed that the teachers' factor more often than not is the main cause of students' failure.

For Salandanan (2007), universities offering teacher education programs must have a continuing professional education and development plan (CPE) to raise the initial qualification of its teaching and non-teaching staff, thereby attaining a high standard of teaching performance and values inculcation. Modes of continuing professional education may be done by having an updated model wherein professionals are provided with levels of knowledge and skills comparable to those graduating at the time; a competence model

where the required competency is provided to continue practice and is measured by the capacity to perform and performance itself; and a performance model which focuses on all variables which are demonstrated to influence the professional's performance and based on the act of performing a job efficiently, skillfully and completely.

New trends, methodologies, and methods are sought by teachers to make their classrooms innovative, interactive, and dynamic. These teachers are keen in finding out new methods so that learners can excel in the classroom. Aranillo (2006) enumerated such methods that teachers can use in modern classrooms such as lectures, panels, films, slide shows, forum, videotapes, demonstrations, drills, case studies, and games.

Related Studies

Level of Knowledge

In 2007, A.A., Adediwura and Bada Tayo's study focused on Nigerian senior high school students' perception on their performance of the teacher's mastery of subject matter knowledge, work attitude, and skill. Fifteen secondary schools were selected and had 1,600 respondents who answered a four-section battery test. This study indicated that there was a very high significance attributed by students to teachers for their ability to perform well in school.

On the other hand, Rivera et. al. (2010) found out that the educational attainment of faculty does not significantly affect their teaching performance.

Meanwhile, Los Angeles Unified school district was chosen in Kane and Staiger's (2008). A notable finding in this study was that a three-year old teacher had equal merits as

that of a senior teacher in the school. The researchers deduced that there is a period of accelerated effectiveness improvement in teachers during their first few years of practice. There is also a plateau in increase of teaching effectiveness over time. The study recommends that administrators take this into consideration when evaluating teachers and improving their efficiency.

In the study made by Ampo (2007) found out that the educational qualification and the teaching experience of the part-time faculty members have a significant effect on their teaching performance. It was recommended in his study that teachers should apply for positions wherein their area of specialization is needed to foster greater teaching performance as they would find it more favorable to handle which are familiar to them and of which they are highly knowledgeable.

Another study that focused on pedagogical knowledge of high school math teachers came from Krauss, S., Brunner, M., Kunter, M., Baumert, J., Blum, W., Neubrand, M., & Jordan, A. (2008). German mathematics teachers were the chosen respondents through tests. Their findings demonstrated that teachers with a deeper type of training in mathematics had higher scores in the exam and they have a firmer grasp of the knowledge categories.

In addition, the Van Hiele theory and acquisition scales of Gutiérrez, Jaime and Fortuny were used to study the geometry knowledge level of Grade 7 teachers. The study declared that the teacher populations in the study failed to achieve the required knowledge level for success. This lack of control of the Grade 7 teachers' geometry knowledge was a

pivotal conclusion from the study conducted by Sandt, S. van der, & Nieuwoudt, H. D. (2003).

Technological Pedagogical Content Knowledge (TPACK) was the focus for studying 1,185 pre-service teachers in Singapore by Koh, J. H. L., Chai, C. S., & Tsai, C. C. (2010). The exploratory factor analysis revealed 5 TPACK constructs: “technological knowledge, content knowledge, knowledge of pedagogy, knowledge of teaching with technology and knowledge from critical reflection.” Gender played a role in setting some differences in perception of the factors. In this study, however, teaching level and age did not play a significant role compared to other previous studies.

A linear mixed model was used as a method in a study that explores the contribution of math knowledge to student achievement. First and third graders were studied for a year and it was found that there was a significant relationship between their achievements vis-à-vis the mathematical knowledge of the teachers. This is of particular interest because the mathematical knowledge was measured specifically at student and teacher level covariates. The study by Hill, H. C., Rowan, B., & Ball, D. L. (2005) recommended improvements by means of initiatives in school policy in this light.

Eighty secondary school teachers were investigated by a study done by Beijaard, D., Verloop, N., & Vermunt, J. D. (2000). It focused on a questionnaire where the perceptions of teachers of themselves as subject matter, pedagogical and didactical experts were studied as part of their professional identity. Based on these collected perceptions which varied from one teacher to another, five profiles of a teacher emerged. While the

study was insightful, contextual, biographical and experiential factors were not taken into account and are essential in influencing each individual teacher's perception.

Considering all the inputs from the studies cited, teachers' knowledge in their respective domains has a great impact on students' ability to synthesize thinking skills and ideal for mathematics. Despite this, there is a limited amount of literature which quantitatively measured the knowledge levels. One such attempt to quantitatively measure and conceptualize domain knowledge came from the study of H. C., Ball, D. L., & Schilling, S. G. (2008) using analysis of multiple choice exam results, piloting and writing.

Teaching Skills

It has been previously established that modernization necessitates the cultivation of good teaching skills. A great amount of literature points to the interplay between teaching skill and teaching success as reflected in student achievements.

For example, ANOVA results from the study by Abduliahi and Onasanya (2010) revealed numerous factors that affected teacher effectiveness. Aside from the qualifications of the teacher, teaching skills that come from experience play a pivotal role in improving students' poor achievements in Mathematics. The multiple regression analysis conducted in this study was able to unveil that the independent variables studied directly predicted the nuance of students' achievement. Suitable and relevant facilities were recommended in the study for this purpose.

According to Verzosa, D. B., & Mulligan, J. (2012), Filipino children have a greater hurdle in learning mathematics because of language issues. The problems are solved in English which is not the native or inherent language being practiced at home and may only

be familiar to students when they are school. In this study, a two-year design was proposed to help word problem solving issues among second graders in the Philippines. The intervention made use of Filipino language for instructing the mathematical concepts on 17 children in a period of 10 weeks. The study revealed that the intervention was able to provide improvements but constrained by the need to keep the language translations free of difficult words that can complicate it further.

Modern students require a new set of teaching skills for success. The transmission model that was traditionally used is now outdated. Despite this, lectures and textbooks remain to be the prominent method of instruction across the country. Retention is presented to be more difficult in this light, according to Saavedra, A. R., & Opfer, V. D. (2015).

The study of Avargil, S., Herscovitz, O., & Dori, Y. J. (2012) took these considerations seriously in their investigation of factors that can make educational reform successful. New curricula, new perceptions, new strategies and new content collectively form the foundation of a successful educational reform strategy. They cited an Israeli high school example where “context-based chemistry and higher order thinking skills” served as the main framework for the chemistry curriculum revision. The highest stages in teachers’ growth was found to have emerged from assessment knowledge (AK), pedagogy knowledge (PK), content knowledge (CK) and pedagogical content knowledge (PCK).

Meanwhile, training impact was studied by Gibbs, G., & Coffey, M. (2004). Twenty two universities in eight countries were cited. Teachers who trained for a year were compared with a control group of teacher who remained as they are without training. There were three aspects where improvement or significant differences were observed: 1) student

evaluation of teachers, 2) how the teachers described themselves (teacher or student focused) and 3) how students took approach to learning (deep or surface only). Untrained teachers from the control group fell behind or had negative changes observed in light of these parameters a year after the study began.

In a study of 1,003 elementary teachers by Dilekli, Y., & Tezci, E. (2016), the relationship between a teacher's teaching skills to efficacy in teaching styles was capitalized. The Teachers Classroom Practices for Teaching Thinking Scale, Teaching Thinking Skills Scale and Grasha's Teaching Style Scale were used. Findings revealed that the Facilitator teaching style possessed the highest self-efficacy for teachers. "Facilitating model was more meaningful one than delegator, expert, authority and personal models." Nuances also showed some minimal changes presented by the delegator model under specific circumstances, but facilitator remained to be the topmost significant model as far as self-efficacy of teachers are concerned

Kaipa, P., Milus, T. (2013), on the other hand, focused on the role of soft skills integration in secondary schools that teach the Malay language. The study highlighted the immense need for teachers to integrate soft skills properly to their practice to be able to conduct effective language teaching and foster the maximum in students' learning processes. Training in doing such was recommended by the researchers. This focus on soft skills integration was further investigated by Tang Keow Ngang (2015). A soft skills training program for teachers in Malaysian universities was devised in this subsequent study. There was an implication that teachers did not receive proper training in soft skills during their stay in universities prior to actual teaching practice. Fifteen public university

teaching graduates who were in practice for less than three years were interviewed in a cycle of three focus group settings. The following soft skills were assessed: “communication, critical and problem solving, team work, life-long learning and management of information, entrepreneurship, ethics, moral and professional, and leadership.” Out of these seven, six were considered as important in teaching (removed entrepreneurship). The novice teachers interviewed expressed concern regarding their lack of soft skills and highlighted a need for additional training and continuous skills upgrade in soft skills that will serve to complement their subject matter mastery in teaching subjects like mathematics or language.

To develop teaching skills, Biermann, A., Karbach, J., Spinath, F. M., & Branken, R. (2015) asserted that field experience during a teacher’s education has a very important role. Student teachers in Germany were their respondents in the study. The linkage between theory and practice was palpable. The quality of the student teachers’ internship helped establish this linkage.

According to Baumfield V. (2006), approaches to thinking skills are a proponent of inquiry-based learning. The first part of the paper examines the impact of teaching thinking skills on teachers by drawing upon a systematic review of research evidence. The second part of the paper sets the characteristics identified in the context of research into teachers’ development and considers the contribution of a pedagogy based on thinking skills approaches to continuing professional development.

Mathematics Teaching

Talangbayan (2007) investigated the relevance of length of service to teaching performance. The results showed that the number of years rendered by a teacher has nothing to do with teaching performance based on the evaluation of students. However, it was established out that years of teaching significantly affect teaching performance as evaluated by the same components of DECS' Performance Appraisal System for Teachers (PAST).

A more recent study by Gloria (2009) revealed that teachers are pursuing higher level of education but barely half of the teacher respondents specialized in the subject they taught. It was recommended in her study that it would favorable if teachers handle subjects which are in line with their area of specialization so that they may be more effective in imparting concepts and principles to their students.

Along with, Lubuguin (2010) made a study on the continuing professional education of teachers in REINA area in the Division of Quezon. It was found in her study that majority of the teachers have units MS/MA; they heed positively to the Continuous Professional Education Mandate not only to develop professionally but also to earn merits during evaluation. Participation to research and extension shows indicative relationship to teachers' performance. However, it was found in her study that continuing professional education of teachers is not significantly associated with their emotional competence.

Kelly (1994) as mentioned by Arceno (2008) stressed that the effective and efficiency of learning depends upon how will the classroom teacher understands and applies what is known about the learning process. This means that learning cannot be

merely a process of passive assimilation or absorption but is one which necessitates on the part of the learner. Teachers and students should work hand and hand so that a wholesome output should be realized.

Bagano's (2006) on his investigation of factors affecting performance in Mathematics II concludes that among all others that the students' mental ability and their perception on their mathematics teacher's practices are factors that are significantly affect the performance of the students in Mathematics.

This intricate a conceptualization of mathematics for teaching as a form of applied mathematics using Bass's idea of characterizing mathematics education as a form of applied mathematics and we examine implications of this conceptualization for the mathematical preparation of teachers. The study focuses on issues of design and implementation of a special kind of mathematics tasks whose use in mathematics teacher education can support the development of knowledge of mathematics for teaching. Broader implications of the article for mathematics teacher education, including implications for mathematics teacher educators' knowledge for promoting mathematics for teaching were included. Stylianides, G. J., & Stylianides, A. J. (2010)

Franke, M. L., Kazemi, E., & Battey, D. (2007) review looks at three features of classroom practice based on a dual focus. It was reviewed that supporting discourse, establishing norms and building relationships for doing and learning mathematics is important. Next, it is done all while focusing on the teacher's role mathematical work and the student's experience of classroom practice. Discourse, norms, and relationship are

intertwined in creating a mathematics classroom where teaching and learning are built on understanding.

Davis, B., & Simmt, E. (2006) offers another review about teachers' mathematics for teaching as well as using complexity science as a framework for interpretation. The researchers illustrate some teachers' interactions around mathematics that arose in the context of an in-service session. Also, they use the events from that session to illustrate four intertwining aspects of teachers' mathematics-for-teaching. According to discussions they label the aspects "mathematical objects," "curriculum structures," "classroom collectivity," and "subjective understanding". Furthermore, drawing on complexity science, we argue that these phenomena are nested in one another and that they obey similar dynamics, albeit on very different time scales. They speculate that a particular fluency with these four aspects is important for mathematics teaching and that these aspects might serve as appropriate emphases for courses in mathematics intended for teachers.

Documents of written accounts of collegiate mathematics teaching exist such as mathematicians' reflections and analyses of learning and teaching in innovative courses research on collegiate teachers' actual classroom teaching practice is not current. Reviewing these journals and peer scholars who teaches mathematics are being done. The researcher distinguish between instructional activities and teaching practice and present six categories of published scholarship that consider collegiate teaching but are not descriptive empirical research on teaching practice. Furthermore, it can reveal important differences among teachers' thinking and actions, promote discussions of practice, and support learning about teaching. In support to the study a developed a preliminary framework of cognitively

oriented dimensions of teaching practice based on our review of empirical research on pre-college and college teaching was created. Speer, N. M., Smith, J. P., & Horvath, A. (2010).

A study who involved thirteen Australian teachers who had been nominated by their professional mathematics teachers' associations as excellent teachers of elementary school mathematics was done. They were interviewed on their beliefs about mathematics, mathematics learning and mathematics teaching. The interview focused on the discussion of the characteristics of effective teachers of mathematics and excellent mathematics lessons. Knowing their differences in location, experience and teacher education, the teachers demonstrated consistency in their responses and in their lists of characteristics. Perry, B. (2007)

It is recommended that co-teaching in mathematics will help in providing students with disabilities access to the general education teacher and the general education curriculum. It should be looked into the characteristics of the mathematics curriculum at the high school level then limited knowledge of special education teachers in mathematics content and last should be the structure of secondary co-taught mathematics classes. Magiera, K., Smith, C., Zigmond, N., & Gebauer, K. (2005)

Synthesis

The aforementioned literatures support the study by giving meanings to what the major variables involved. It led to a deeper understanding on what was the researchers' basis. It gave her the hints to venture in determines the levels of knowledge and teaching skills of mathematics teachers toward mathematics in FVR National High School. The

related concepts and previous studies discussed in this chapter provided clearer direction of the study and its scope.

Chapter III

RESEARCH METHODOLOGY

This chapter describes the research design, the subject and respondents, the data-gathering procedure, the analytical scheme, and the statistical tools that will be used in this study.

Research Design

This study used the descriptive method of research. Descriptive research describes what the causes of behaviors and situations are, as it exists at the time in the study. It involves the description, recording, analysis and interpretation of the particular condition (Garcia, 2009). It involves some types of comparison and attempts to discover relationship between variables. In this study, it attempted to determine the levels of knowledge and teaching skills of mathematics teachers in FVR National High School.

Respondents of the Study

The subject of this study is the levels of knowledge and teaching skills of mathematics teachers towards mathematics subjects in FVR National High School during the academic year 2016-2017. There are two groups of respondents who cooperated in this study. Respondents of the study were made up of 8 mathematics teachers of FVR National High School. The other group of respondents was composed of 1389 as the total population whereby 200 students was a sample of the study.

Table 1

Distribution of Mathematics Teachers in FVR National High School

Grade Level	Number of Mathematics Teachers
Grade 7	2
Grade 8	2
Grade 9	2
Grade 10	2
Total	8

Table 1A

Distribution of Students in Public FVR National High School

Grade Level	N	n
Grade 7	341	52
Grade 8	350	53
Grade 9	304	46
Grade 10	327	49
Total	1322	200

Research Instrument

To collect the needed data for the mathematics teachers and their students for this study the questionnaire was used. The items in the questionnaire were formulated based on the researcher's readings of several magazines, books, journals and studies related to the concern of the study.

The instrument consists of 30 item test, which elicited data on the level of knowledge and teaching skills of Mathematics teachers as perceived by themselves and their students.

Area I focus on the teacher's knowledge with 15 items on the subject matter, pedagogical content and teaching preparation. 15 items on Area II for teaching skills with the sub-areas of: classroom management, appropriate use of instructional materials and teaching strategies. The assessment questionnaire provides insights on the level of knowledge and skills of mathematics teachers toward mathematics. The responses of "very high", "high", "moderate", "low" and "very low" received a value of 5, 4, 3, 2, and 1 respectively.

The research instrument that was used in the present study was subjected to content and face validation by two jurors, who are professionals in the field of education. Both of them attested to the appropriateness and validity of the questionnaire as to the item raised therein set forth by Carter V. Good and Douglas B. Scates.

The items of the questionnaire was referred to and discussed with department heads, school administrators and teachers in order to elicit information and opinion as to the appropriateness of the items found therein. In establishing the reliability of the data-

gathering instruments, the researcher utilized the test-retest reliability technique, which involves Mathematics teachers from one of the private schools in Norzagaray as dry run respondents of the study.

Sampling Procedure

This study covered mathematics teachers in FVR National High School. These teachers were asked to evaluate themselves as to the level of their knowledge and teaching skills towards mathematics. Students of FVR National High School were also included in this study. They served as respondents by assessing their mathematics teachers.

Teachers who were included in the study were determined through total enumeration while the number of students was determined through stratified random sampling. The number of students included in the study was proportionately drawn from the population of students in FVR National High School.

Data Gathering Procedure

After establishing the validity and reliability of the data-gathering instrument, sufficient copies of the questionnaires was reproduced needed for gathering of data to the respondents after securing the necessary permission from the concerned school authorities. The purpose and the significance of the study were explained fully to the respondents of the study whose responses were kept in strictest confidence.

The researcher personally administered and distributed the questionnaires to the teachers and students in order for her to ensure immediate retrieval of the same, and at the same time to answer the questions on issues that require clarification. Thus, enable her to

retrieve immediately the questionnaire as well as ensuring her of one hundred percent retrieval of the same.

All computations were done using the SDA (Statistical Data Analysis) method. The data was analyzed, and interpreted according to the specific problems, and the hypotheses that are set forth in the introductory part of this report.

Statistical Treatment

The quantitative technique was employed in the analysis of the data varies according to the specific objectives set forth in the study.

The objective which seeks to determine the levels of knowledge and teaching skills of mathematics teachers in FVR National High School, it was determined through the application of weighted mean. To solve for weighted mean, the formula is given below.

$$W\bar{X} = \frac{\sum fx}{N}$$

where, $W\bar{X}$ = weighted mean

f = frequency of responses

w = weight of the scale

N = sum of all the cases

The analysis of the difference in the evaluation made by teachers on their levels of knowledge and teaching skills and the ratings made by their students was done with the use of t-test for independent sample means. The formula used for t-test for independent sample means is:

$$t = \frac{(\bar{X}_1 - \bar{X}_2)}{\sqrt{\frac{(N_1 - 1)s_1^2 + (N_2 - 1)s_2^2}{N_1 + N_2 - 2}} \sqrt{\frac{1}{N_1} + \frac{1}{N_2}}}$$

where, t = t-test statistics

$\bar{X}_1$ = mean of the first group

$\bar{X}_2$ = mean of the second group

s_1^2 = variance of the first group

s_2^2 = variance of the second group

N_1 = number of cases of the first group

N_2 = number of cases of the second group

The t-test for independent sample means is actually a t-test for the observed difference between two sample means that are not correlated with each other. This specific test is used to determine if an observed difference between the averages of the two groups is statistically significant.

Chapter IV

FINDINGS AND DISCUSSION

This chapter presents the findings of the study. The data gathered, its analysis and interpretation of the data were also presented.

OBSERVATIONS OF THE RESPONDENTS ON THE LEVEL OF KNOWLEDGE AND TEACHING SKILLS OF MATHEMATICS TEACHER IN FVR NATIONAL HIGH SCHOOL AS ASSESSED BY STUDENTS AND THEMSELVES

Beliefs about mathematics and its learning and teaching are not the only teacher beliefs that need to be considered when looking for influences on the effectiveness of teaching (Gates, 2006).

Teacher characteristics are the instructional behaviors exhibited by the teacher towards goal attainment. These characteristics are the combination of peculiar qualities, traits, mental or moral nature/strength and status that make one person or group different from another. Successful teachers' characteristics are those that have been found by empirical researches to be related to improve achievement by students in the cognitive, affective or psychomotor outcomes of education.

1.1. Mastery of the Subject Matter

Table 1 shows the responses of the students and teachers on the level of knowledge of Mathematics teachers in FVR National High particularly in the mastery of subject matter.

Table 1.

Level of Knowledge of Mathematics Teacher in Mastery of Subject as Evaluated
by themselves and students

Items	Teachers		Students	
	$\overline{W\bar{X}}$	Interpretation	$\overline{W\bar{X}}$	Interpretation
1. Possesses accurate information.	4.08	HL	4.00	HL
2. Delivers more than facts and information.	4.15	HL	4.03	HL
3. Evaluates students work and provides feedback.	4.17	HL	3.66	HL
4. Knowledge extends beyond the specific topics of the curriculum.	4.09	HL	4.00	HL
5. Relates his/her disciplinary knowledge to other subject areas.	4.26	HL	3.97	HL
Overall weighted mean	4.15	HL	3.93	HL

Legend:

4.51-5.00 Very High Level (VHL)

3.51-4.50 High Level (HL)

2.51-3.50 Moderate Level (ML)

1.51-2.50 Low Level (LL)

1.00-1.50 Very Low Level (VL)

It can be gleaned in the table that the teachers evaluated themselves to have high level of knowledge in the Mastery of Subject as evident by the mean of 4.26 particularly in relating his/her disciplinary knowledge to other subject areas. For students, they observed their teachers to have high level of knowledge in the Mastery of Subject in terms of delivering more than facts and information based on the weighted mean response of 4.03.

As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly competent in item 1, “Possess accurate information”, based on the mean

of 4.08. For the students' evaluation, the mean of 3.66 indicates high level of knowledge of teachers in item 3, "Evaluates students work and provides feedback."

The overall weighted mean responses of 4.15 for teachers and 3.93 for students indicate high level of knowledge in the mastery of subject in Mathematics.

1.2. Pedagogical Content

Table 2 shows the responses of the students and teachers on the level of knowledge of Mathematics teachers in FVR National High particularly in pedagogical content.

It can be seen in the table that the teachers evaluated themselves to have high level of knowledge in pedagogical content as evident by the mean of 4.26 particularly in creating lesson plans that move through the easier material quickly and provide more time for the difficult lessons. For students, they observed their teachers to have high level of knowledge in pedagogical content in terms of having the ability to create solutions to overcome students' learning difficulties based on the weighted mean response of 4.10.

As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly competent in item 4, "Forms appropriate criteria for assessment and assesses students' answers according to these criteria", based on the mean of 4.12. For the students' evaluation, the mean of 3.85 indicates high level of knowledge of teachers in item 2, "Works with students existing conceptions and prior knowledge."

Table 2.

Level of Knowledge of Mathematics Teacher in Pedagogical Content as Evaluated
by themselves and students

Items	Teachers		Students	
	$\overline{W\bar{X}}$	Interpretation	$\overline{W\bar{X}}$	Interpretation
1. Creates lesson plans that move through the easier material quickly and provide more time for the difficult lessons.	4.26	HL	4.00	HL
2. Works with students existing conceptions and prior knowledge.	4.16	HL	3.85	HL
3. Has the ability to create solutions to overcome students' learning difficulties.	4.20	HL	4.10	HL
4. Forms appropriate criteria for assessment and assesses students' answers according to these criteria.	4.12	HL	3.86	HL
5. Gives varying activities that allows for the development of students' skills and interests.	4.13	HL	3.83	HL
Overall weighted mean	4.17	HL	3.93	HL

Legend:

4.51-5.00 Very High Level (VHL)

3.51-4.50 High Level (HL)

2.51-3.50 Moderate Level (ML)

1.51-2.50 Low Level (LL)

1.00-1.50 Very Low Level (VL)

The overall weighted mean responses of 4.17 for teachers and 3.93 for students indicate high level of knowledge in pedagogical content in Mathematics.

1.3 Teaching Preparation

Table 3 shows the responses of the students and teachers on the level of knowledge of Mathematics teachers in FVR National High particularly in the teaching preparation

Table 3.

Level of Knowledge of Mathematics Teacher in Teaching Preparation as Evaluated by themselves and students

Items	Teachers		Students	
	$\overline{W \bar{X}}$	Interpretation	$\overline{W \bar{X}}$	Interpretation
1. Makes a good plan and organizes his/her lessons well.	4.19	HL	3.86	HL
2. Continues to study and learn.	4.24	HL	4.00	HL
3. Systematically develops objectives, questions, and activities that reflect higher-level and lower-level cognitive skills as appropriate for the content and the students.	4.30	HL	4.00	HL
4. Considers student attention spans and learning styles when designing lessons.	4.10	HL	3.97	HL
5. Plans academic enrichment and remediation opportunities for students.	3.99	HL	3.97	HL
Overall weighted mean	4.16	HL	3.96	HL

Legend:

4.51-5.00 Very High Level (VHL)

3.51-4.50 High Level (HL)

2.51-3.50 Moderate Level (ML)

1.51-2.50 Low Level (LL)

1.00-1.50 Very Low Level (VL)

As showed in the table that the teachers evaluated themselves to have high level of knowledge in the teaching preparation as evident by the mean of 4.30 particularly in

systematically developing objectives, questions, and activities that reflect higher-level and lower-level cognitive skills as appropriate for the content and the students. For students, they observed their teachers to have high level of knowledge in the teaching preparation in terms of continue studying and learning and systematically developing objectives, questions, and activities that reflect higher-level and lower-level cognitive skills as appropriate for the content and the students based on the weighted mean response of 4.00.

As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly competent in item 5, “Plans academic enrichment and remediation opportunities for students”, based on the mean of 3.99. For the students’ evaluation, the mean of 3.86 indicates high level of knowledge of the teachers in item 1, “Makes a good plan and organizes his/her lessons well.”

The overall weighted mean responses of 4.16 for teachers and 3.96 for students indicate high level of knowledge in the teaching preparation in Mathematics.

2.1. Classroom Management

Table 4 shows the responses of the students and teachers on the level of teaching skills of Mathematics teachers in FVR National High particularly in the classroom management.

It can be gleaned in the table that the teachers evaluated themselves to have high level of skill in classroom management as evident by the mean of 4.35 particularly in preparing and managing class time wisely. For students, they observed their teachers to have high level of skill in classroom management in terms of clearly outlining academic and behavioral expectations based on the weighted mean response of 4.23.

Table 4.

Level of Skills of Mathematics Teacher in Classroom Management as Evaluated
by themselves and students

Items	Teachers		Students	
	$\bar{W \bar{X}}$	Interpretation	$\bar{W \bar{X}}$	Interpretation
1. Prepares and manages class time wisely.	4.35	HL	3.63	HL
2. Clearly outlines academic and behavioral expectations.	4.27	HL	4.23	HL
3. Encourages the non-threatening atmosphere and the participation of all students.	3.93	HL	3.49	HL
4. Establishes a classroom culture in which students are required to respect one another.	4.10	HL	4.10	HL
5. Monitors students carefully and frequently so that misbehavior is detected early before it involves students or becomes a serious disruption.	4.10	HL	3.97	HL
Overall weighted mean	4.15	HL	3.88	HL

Legend:

4.51-5.00 Very High Level (VHL)

3.51-4.50 High Level (HL)

2.51-3.50 Moderate Level (ML)

1.51-2.50 Low Level (LL)

1.00-1.50 Very Low Level (VL)

As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly skilled in item 3, “Encourages the non-threatening atmosphere and the participation of all students”, based on the mean of 3.93. For the students’ evaluation, the mean of 3.49 indicates high level of skill of teachers in item 3, “Encourages the non-threatening atmosphere and the participation of all students.”

The overall weighted mean responses of 4.15 for teachers and 3.88 for students indicate high level of skill in classroom management.

2.2. Appropriate Use of Instructional Materials

Table 5 shows the responses of the students and teachers on the level of teaching skills of Mathematics teachers in FVR National High particularly in the appropriate use of instructional materials.

It can be gleaned in the table that the teachers evaluated themselves to have high level of skill in the appropriate use of instructional materials as evident by the mean of 4.26 particularly in using materials which are current and reflect the diverse uses and applications of mathematics. For students, they observed their teachers to have high level of skill in the appropriate use of instructional materials in terms of using materials which are current and reflect the diverse uses and applications of mathematics with a mean of 3.88.

As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly skilled in item 5, “Uses materials which reflect high expectations for all students regardless of race, culture, gender, religion, physical condition, and socioeconomic background”, based on the mean of 4.06. For the students’ evaluation, the mean of 3.66 indicates high level of skills of teachers in item 5, “Uses materials which reflect high expectations for all students regardless of race, culture, gender, religion, physical condition, and socioeconomic background.”

Table 5.

Level of Skills of Mathematics Teacher in the Appropriate Use of Instructional Materials
as Evaluated by themselves and students

Items	Teachers		Students	
	$\overline{W\bar{X}}$	Interpretation	$\overline{W\bar{X}}$	Interpretation
1. Uses materials which are appropriate to the intended level.	4.17	HL	3.83	HL
2. Uses materials which are current and reflect the diverse uses and applications of mathematics.	4.26	HL	3.88	HL
3. Uses materials which ensure active student participation in learning, creating, doing, and evaluating mathematics.	4.18	HL	3.83	HL
4. Uses materials which emphasize how mathematics should be taught as well as what should be taught.	4.24	HL	3.86	HL
5. Uses materials which reflect high expectations for all students regardless of race, culture, gender, religion, physical condition, and socioeconomic background.	4.06	HL	3.66	HL
Overall weighted mean	4.18	HL	3.81	HL

Legend:

4.51-5.00 Very High Level (VHL)

3.51-4.50 High Level (HL)

2.51-3.50 Moderate Level (ML)

1.51-2.50 Low Level (LL)

1.00-1.50 Very Low Level (VL)

The overall weighted mean responses of 4.18 for teachers and 3.81 for students indicate high level of skill in the appropriate use of instructional materials in Mathematics.

2.3. Teaching Strategies

Table 6 shows the responses of the students and teachers on the level of teaching skills of Mathematics teachers in FVR National High particularly in teaching strategies.

Table 6.

Level of Skills of Mathematics Teacher in Teaching Strategies as Evaluated by themselves and students

Items	Teachers		Students	
	$\overline{W \bar{X}}$	Interpretation	$\overline{W \bar{X}}$	Interpretation
1. Uses different techniques in teaching and a variety of modes of instruction.	4.31	HL	4.00	HL
2. Adheres to student-centered approach and recognizes individual differences of students.	4.11	HL	3.97	HL
3. Encourages a wide variety of strategies in problem solving and investigation.	4.07	HL	3.66	HL
4. Creates learning environment that are interactive.	4.03	HL	3.66	HL
5. Uses aids in teaching diverse learning styles effectively.	4.10	HL	3.63	HL
Overall weighted mean	4.12	HL	3.78	HL

Legend:

4.51-5.00 Very High Level (VHL)

3.51-4.50 High Level (HL)

2.51-3.50 Moderate Level (ML)

1.51-2.50 Low Level (LL)

1.00-1.50 Very Low Level (VL)

It can be gleaned in the table that the teachers evaluated themselves to have high level of skill in teaching strategies as evident by the mean of 4.31 particularly in using different techniques in teaching and a variety of modes of instruction. For students, they

observed their teachers to have high level of skill in teaching strategies in terms of using different techniques in teaching and a variety of modes of instruction with a mean of 4.00.

As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly skilled in item 4, “. Creates learning environment that are interactive”, based on the mean of 4.03. For the students’ evaluation, the mean of 3.63 indicates high level of skills of teachers in item 5, “Uses aids in teaching diverse learning styles effectively.”

The overall weighted mean responses of 4.12 for teachers and 3.78 for students indicate high level of high level of skill in teaching strategies in Mathematics.

3. Differences between the Assessments of Mathematics Teachers and their Students

Table 7.

Difference between the Ratings Made by Teachers and Students on the Level of Knowledge and Teaching Skills of Mathematics Teachers

Variables	Mean Rating		Computed t-value	df	Tabular t-value (p <.05)	Interpretation
	Teachers	Students				
Knowledge						
Mastery of the Subject Matter	4.13	3.95	2.19	148	1.98	Significant
Pedagogical Content	4.18	3.85	3.96	148	1.98	Significant
Teaching Preparation	4.10	3.79	3.91	148	1.98	Significant
Teaching Skills						
Classroom Management	4.14	3.95	2.08	148	1.98	Significant
Appropriate Use of Instructional Materials	4.17	3.73	4.81	148	1.98	Significant
Teaching Strategies	4.15	3.82	3.94	148	1.98	Significant

It can be gleaned in the table that in terms of Mastery of the Subject Matter, the computed t-value of 2.19 was lower than the critical t-value of $t = 1.98$ at 5 percent level of significance using degrees of freedom of 148. This means that there is significant

difference in the ratings made by the teachers and students on the level of knowledge in terms on Mastery of the Subject Matter.

In terms of *Pedagogical Content*, the mean difference between the teachers and students is significant. This finding was based on the computed t-values of 3.96 which is greater than the critical value of 1.98 at 5 percent level of significance. In terms of *Teaching Preparation*, the computed t-value of 3.91 is greater than the critical value of $t = 1.98$ at 5 percent level of significance.

Moreover, It can also be seen in the table that in terms of *Classroom Management*, the computed t-value of 2.08 was lower than the critical t-value of $t = 1.98$ at 5 percent level of significance using degrees of freedom of 148. In terms of *Appropriate Use of Instructional Materials*, the mean difference between the teachers and students is significant. This finding was based on the computed values of 4.81 which is greater than the critical value of 1.98 at 5 percent level of significance. In terms of *Teaching Strategies*, the computed t-value of 3.94 is greater than the critical value of $t = 1.98$ at 5 percent level of significance.

The results of the present study indicate a marked significant difference in the ratings made by the two groups of respondents in the level of knowledge of teachers.

4. Enhancement Program that can be Developed as a Basis to Improve the Mathematics Teachers' Knowledge and Teaching Skills in FVR National High School

Table 8.

Enhancement Program for the Level of Knowledge and Teaching Skills of Mathematics Teachers

Variables	Teachers		Students		Enhancement Program
	$\overline{W\bar{X}}$	Interpretation	$\overline{W\bar{X}}$	Interpretation	
Knowledge					
Mastery of the Subject Matter	4.13	HL	3.95	HL	In-Service Refresher Program
Pedagogical Content	4.18	HL	3.85	HL	In-Service Training Program on Pedagogical Content Knowledge
Teaching Preparation	4.10	HL	3.79	HL	School-Based Mentoring Program on Teaching Preparation
Teaching Skills					
Classroom Management	4.14	HL	3.95	HL	Peer Support Program on Classroom-Based Management
Appropriate Use of Instructional Materials	4.17	HL	3.73	HL	Program on the Analysis of Use and Management of Instructional Materials
Teaching Strategies	4.15	HL	3.82	HL	School-Based Strategy Training Program

Legend:

4.51-5.00 Very High Level (VHL)
 3.51-4.50 High Level (HL)
 2.51-3.50 Moderate Level (ML)

1.51-2.50 Low Level (LL)
 1.00-1.50 Very Low Level (VL)

Table 8 shows the enhancement program for the level of knowledge and teaching skills of mathematics teachers.

It can be seen in the table that the responses of teachers and students indicates a high level of skill in terms of mastery of the subject matter. This result suggests developing an *In-Service Refresher Program*. In terms of pedagogical content, the result suggests that mathematics teachers should undergone *In-Service Training Program*.

School-Based Mentoring Program on Teaching Preparation is recommended for teachers as a result of the responses of teachers and students on the level of knowledge particularly in the teaching preparation.

It can be gleaned in the table that the teachers and students evaluated the level of teaching skills of teachers to have high level in classroom management. Accordingly, *Peer Support Program on Classroom-Based Management* should be developed.

Moreover, as to the responses of the subjects of the study, the mathematics teachers are evaluated to have high level in terms of appropriate use of instructional materials. As such, *Program on the Analysis of Use and Management of Instructional Materials* is recommended.

It can also be seen in the table that in terms of teaching strategy, *School-Based Strategy Training Program* development will improve the mathematics teachers' skills.

The results of the present study suggest the development of enhancement programs for the level of knowledge and teaching skills of mathematics teachers.

Chapter V

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY OF FINDINGS

The study aimed to determine the levels of knowledge and of teaching skills and of mathematics teachers towards mathematics in FVR National High School of Norzagaray, Bulacan during the school year 2016-2017. The questionnaire was used as the tool in gathering the needed information about the said matter. This descriptive study involved 8 Mathematics teachers and 200 students from FVR National High School of Norzagaray, Bulacan. An enhancement program can be developed as basis to improve the mathematics teacher's knowledge and teaching skills was recommended. The statistical tools used to analyze the data that provide answers to the subproblems were given as follows: weighted mean and t-test for independent sample means. The findings of the study are given below:

FINDINGS

1.1 Mastery of the Subject Matter

Responses of the students and teachers on the level of knowledge of Mathematics teachers in FVR National High particularly in the mastery of subject matter showed that the teachers evaluated themselves to have high level of knowledge in the Mastery of Subject as evident by the mean of 4.26 particularly in relating his/her disciplinary knowledge to other subject areas. For students, they observed their teachers to have high level of knowledge in the Mastery of Subject in terms of delivering more than facts and information based on the

weighted mean response of 4.03. As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly competent in item 1, “Possess accurate information”, based on the mean of 4.08. For the students’ evaluation, the mean of 3.66 indicates high level of knowledge of teachers in item 3, “Evaluates students work and provides feedback.” The overall weighted mean responses of 4.15 for teachers and 3.93 for students indicate high level of knowledge in the mastery of subject in Mathematics.

1.2. Pedagogical Content

The responses of the students and teachers on the level of knowledge of Mathematics teachers in FVR National High particularly in pedagogical content revealed that the teachers evaluated themselves to have high level of knowledge in pedagogical content as evident by the mean of 4.26 particularly in creating lesson plans that move through the easier material quickly and provide more time for the difficult lessons. For students, they observed their teachers to have high level of knowledge in pedagogical content in terms of having the ability to create solutions to overcome students' learning difficulties based on the weighted mean response of 4.10. As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly competent in item 4, “Forms appropriate criteria for assessment and assesses students' answers according to these criteria”, based on the mean of 4.12. For the students’ evaluation, the mean of 3.85 indicates high level of knowledge of teachers in item 2, “Works with students' existing conceptions and prior knowledge.” The overall weighted mean responses of 4.17 for teachers and 3.93 for students indicate high level of knowledge in pedagogical content in Mathematics.

1.3 Teaching Preparation

The students and teachers on the level of knowledge of Mathematics teachers in FVR National High particularly in the teaching preparation showed that teachers evaluated themselves to have high level of knowledge in the teaching preparation as evident by the mean of 4.30 particularly in systematically developing objectives, questions, and activities that reflect higher-level and lower-level cognitive skills as appropriate for the content and the students. For students, they observed their teachers to have high level of knowledge in the teaching preparation in terms of continue studying and learning and systematically developing objectives, questions, and activities that reflect higher-level and lower-level cognitive skills as appropriate for the content and the students based on the weighted mean response of 4.00. As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly competent in item 5, “Plans academic enrichment and remediation opportunities for students”, based on the mean of 3.99. For the students’ evaluation, the mean of 3.86 indicates high level of knowledge of the teachers in item 1, “Makes a good plan and organizes his/her lessons well.” The overall weighted mean responses of 4.16 for teachers and 3.96 for students indicate high level of knowledge in the teaching preparation in Mathematics.

2.1. Classroom Management

The students and teachers on the level of teaching skills of Mathematics teachers in FVR National High particularly in the classroom management showed that the teachers evaluated themselves to have high level of skill in classroom management as evident by the mean of 4.35 particularly in preparing and managing class time wisely. For students, they

observed their teachers to have high level of skill in classroom management in terms of clearly outlining academic and behavioral expectations based on the weighted mean response of 4.23. As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly skilled in item 3, “Encourages the non-threatening atmosphere and the participation of all students”, based on the mean of 3.93. For the students’ evaluation, the mean of 3.49 indicates high level of skill of teachers in item 3, “Encourages the non-threatening atmosphere and the participation of all students.” The overall weighted mean responses of 4.15 for teachers and 3.88 for students indicate high level of skill in classroom management.

2.2. Appropriate Use of Instructional Materials

The responses of the students and teachers on the level of teaching skills of Mathematics teachers in FVR National High particularly in the appropriate use of instructional materials resulted that the teachers evaluated themselves to have high level of skill in the appropriate use of instructional materials as evident by the mean of 4.26 particularly in using materials which are current and reflect the diverse uses and applications of mathematics. For students, they observed their teachers to have high level of skill in the appropriate use of instructional materials in terms of using materials which are current and reflect the diverse uses and applications of mathematics with a mean of 3.88. As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly skilled in item 5, “Uses materials which reflect high expectations for all students regardless of race, culture, gender, religion, physical condition, and socioeconomic background”, based on the mean of 4.06. For the students’ evaluation, the mean of 3.66 indicates high level of skills of teachers

in item 5, “Uses materials which reflect high expectations for all students regardless of race, culture, gender, religion, physical condition, and socioeconomic background.” The overall weighted mean responses of 4.18 for teachers and 3.81 for students indicate high level of skill in the appropriate use of instructional materials in Mathematics.

2.3. Teaching Strategies

The responses of the students and teachers on the level of teaching skills of Mathematics teachers in FVR National High particularly in teaching strategies showed that the teachers evaluated themselves to have high level of skill in teaching strategies as evident by the mean of 4.31 particularly in using different techniques in teaching and a variety of modes of instruction. For students, they observed their teachers to have high level of skill in teaching strategies in terms of using different techniques in teaching and a variety of modes of instruction with a mean of 4.00. As to the lowest mean responses of the subjects of the study, the teachers evaluated themselves as highly skilled in item 4, “Creates learning environment that are interactive”, based on the mean of 4.03. For the students’ evaluation, the mean of 3.63 indicates high level of skills of teachers in item 5, “Uses aids in teaching diverse learning styles effectively.” The overall weighted mean responses of 4.12 for teachers and 3.78 for students indicate high level of skill in teaching strategies in Mathematics.

3. Differences between the Assessments of Mathematics Teachers and their Students

In terms of Mastery of the Subject Matter, the computed t-value of 2.19 was lower than the critical t-value of $t = 1.98$ at 5 percent level of significance using degrees of

freedom of 148. This means that there is significant difference in the ratings made by the teachers and students on the level of knowledge in terms on Mastery of the Subject Matter.

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Moreover, It can also be seen in the table that in terms of *Classroom Management*, the computed t-value of 2.08 was lower than the critical t-value of $t = 1.98$ at 5 percent level of significance using degrees of freedom of 148. In terms of *Appropriate Use of Instructional Materials*, the mean difference between the teachers and students is significant. This finding was based on the computed values of 4.81 which is greater than the critical value of 1.98 at 5 percent level of significance. In terms of *Teaching Strategies*, the computed t-value of 3.94 is greater than the critical value of $t = 1.98$ at 5 percent level of significance.

The results of the present study indicate a marked significant difference in the ratings made by the two groups of respondents in the level of knowledge of teachers.

CONCLUSIONS

Based on the findings gathered, the following conclusions were made:

1. The assessment of the mathematics teachers themselves revealed that they were high in terms of teacher's knowledge and teaching skills. This means that mathematics

teachers in FVR National High School have mastery of the subject matter; have broad knowledge of the pedagogical content; and they are well prepared for teaching instruction.

2. Furthermore, this means that mathematics teachers were effective in their classroom management. They also use appropriate instructional materials in teaching of mathematics. Also, they used suitable teaching strategies.

3. Significant differences were noted between the assessment of the two groups of respondents on the knowledge and teaching skills of mathematics teachers. Mathematics teachers assessed significantly differently from the students.

RECOMMENDATIONS

Based on the findings and conclusion of the study, the following are recommended:

1. The result showed a satisfying outcome as far as the perceptions of teachers and students are concerned. However, not all aforementioned areas have been reached to the maximum level especially on the part of the students' assessment which simply implies that there is still room for improvement. Therefore, it is recommended that teachers should be provided with more training, workshops and the like to further improve their level of knowledge and teaching skills

2. Department heads should monitor teachers' performance and students' academic performance. Through this process, teachers will receive an assessment of their level of knowledge and teaching skills for them to strengthen their weak areas.

3. Mathematics teachers of FVR National High School should be informed of the results of this study to make them aware of the level of their knowledge and teaching skills.

As such, they are given the opportunity to evaluate themselves and make possible adjustments in further developing their teaching capabilities.

4. Further studies along this line particularly on the variable not included in this study.

5. Mathematics teachers are encouraged towards professional growth through earning masters and doctoral degrees in their specialized field.

6. The development and implementation of the enhancement programs on the level of knowledge and teaching skills of mathematics teachers.

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